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COMPUTER aRCHITECTURE AND TECHNOLOGY cONVERGENCE

Assignment

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## Q1: Binary Arithmetic:

Feel free to use any resources you need for the tasks below, but make sure to show workings.

### Q1.1. Question

Add 11011 to 1011. Show your work (in particular, show where you get carries, and where you don't). You can check your work by translating the numbers into decimal, but I want to see the addition algorithm in base 2 instead of base ten.

### Q1.1. **Answer**

Binary Addition: Verification:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Carry |  | 1 |  | 1 | 1 |  |
|  |  | 1 | 1 | 0 | 1 | 1 |
|  |  |  | 1 | 0 | 1 | 1 |
| Sum | 1 | 0 | 0 | 1 | 1 | 0 |

|  |  |
| --- | --- |
| Binary | Decimal |
| 11011 | 16+8+0+2+1 = 27 |
| 1011 | 8+0+2+1 = 11 |
| 100110 | 32+0+0+4+2 = 38 |

### 

### Q1.2. Question

Rewrite the following base-10 numbers as 8-bit two's complement integers: -31, & -59.

### Q1.2. **Answer**

**Step 1**: Binary Representation of 31 and 59

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|  |  |  |  |  |  |  |  |  |  |
| 31 |  | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 59 |  | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |

**Step 2**: Invert the binary digits

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 31 |  | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 59 |  | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |

**Step 3**: Add 1 to the result

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Carry |  |  |  |  |  |  |  |  |  |
|  |  | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
|  |  |  |  |  |  |  |  |  | 1 |
| -31 |  | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Carry |  |  |  |  |  |  |  |  |  |
|  |  | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
|  |  |  |  |  |  |  |  |  | 1 |
| -59 |  | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |

### Q1.3. **Question**

What does the bit pattern 11101001 represent if you interpret it as an 8-bit two's complement integer?

### Q1.3. **Answer**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Given Number |  | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| Inversion |  | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |

Step 1: Invert the original Number

Step 2: Add 1 to the inverted number

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Carry |  |  |  |  |  |  |  |  |  |
|  |  | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
|  |  |  |  |  |  |  |  |  | 1 |
|  |  | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |

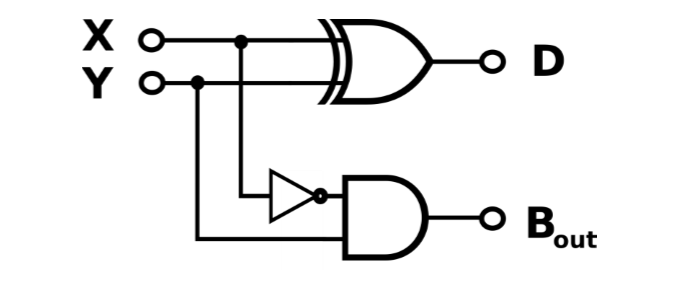
Step 3: Calculate the Decimal Number

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|  |  |  |  |  |  |  |  |  |  |
| 23 |  | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |

Since the original number was negative, the final result is -23.

### Q1.4. Question

Draw up the truth table for the circuit below (inputs are X and Y and outputs are B and D). From observing the result, **what function do you think this circuit performs?**



### Q1.4. Answer

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| XOR  (X) | XOR  (Y) | XOR - Output  D | AND  (X’) | AND  (Y) | Bout |
| 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 |

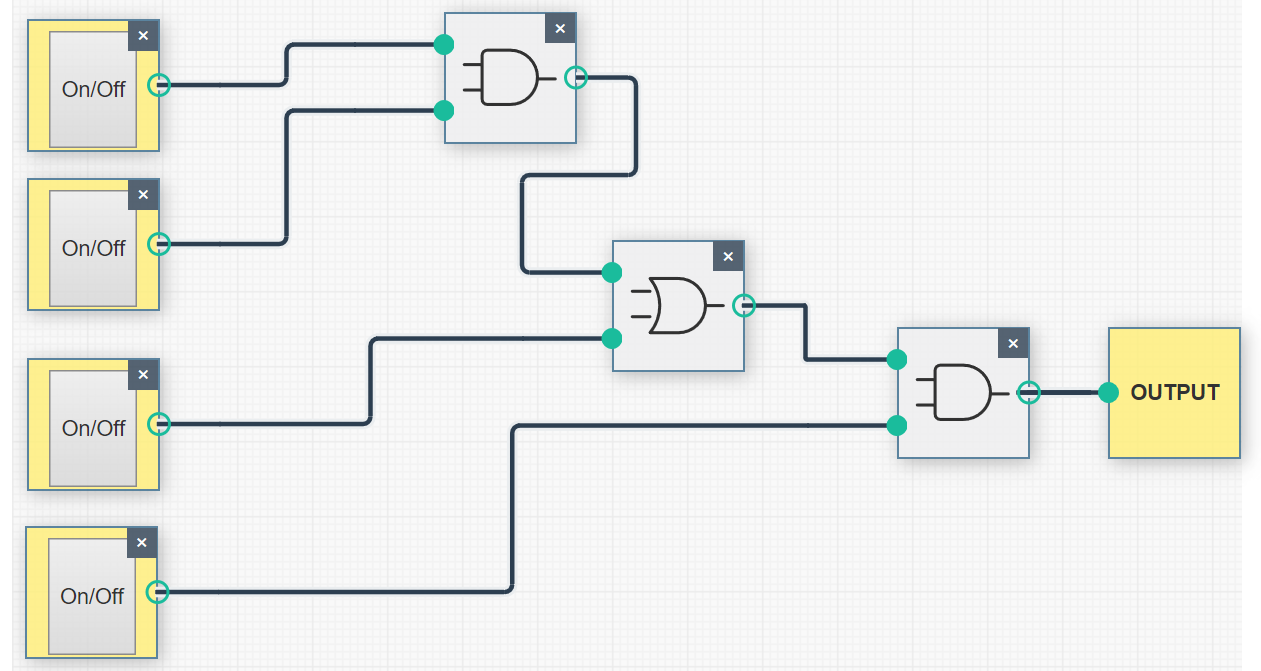
Truth Table

|  |  |  |  |
| --- | --- | --- | --- |
| X | Y | D | Bout |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 |

### Q1.5. Question

Draw the circuit diagram for the Boolean logic equation: (AB + C)D

### Q1.5. Answer

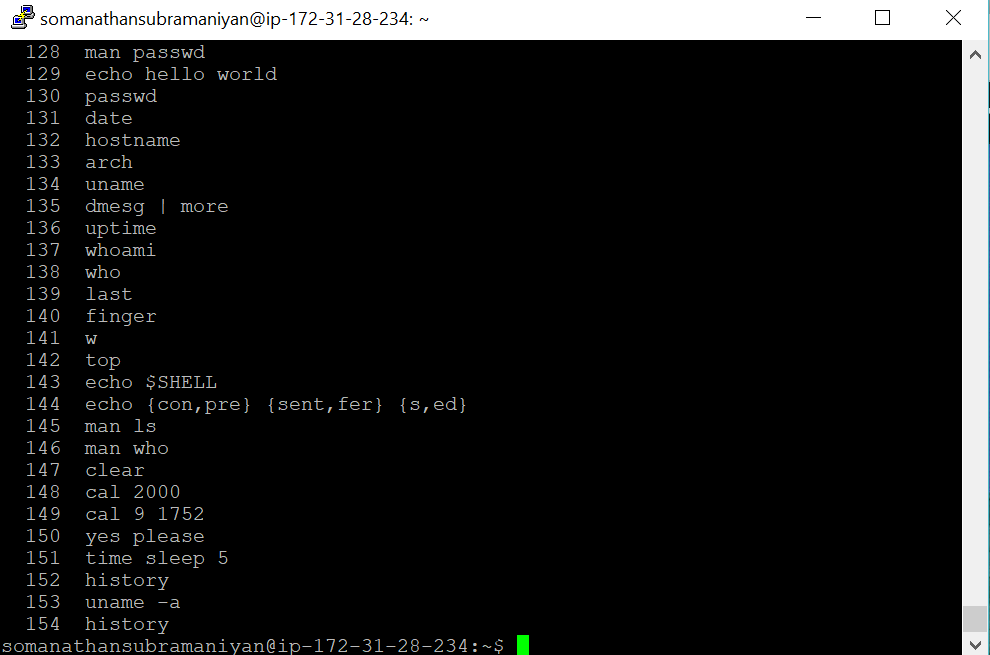


## Q2: Linux Assignment

### Q2.1: Questions

Enter the commands below at the Linux terminal on the AWS VM (on which you completed your Linux Homework),and try to interpret the output.

|  |  |
| --- | --- |
| Command | Description |
| echo hello world | Displays the line of text that follows the command “echo”. |
| passwd | This command allows to change the password of the user account. |
| date | This displays system date and time and also, allows to set the date. |
| hostname | Hostname is used to display (or) Set the systems DNS name . |
| arch | Displays the machines hardware name. |
| uname -a | Prints **all** the system information. |
| dmesg | more | Displays all the messages from the Kernel ring buffer. |
| uptime | Uptime provides  The current time,  How long the system has been running,  How many users are currently logged on, and  The system load averages for the past 1, 5 and 15 minutes. |
| whoami | Displays the current account user name |
| who | Prints information about users who are currently logged in. It displays all the users logged into the system. |
| last | Lists all the last logged in users. |
| finger | User information look up program. Displays users login name, real name, terminal name etc., |
| w | Displays information about the users currently logged on to the machine and their processes |
| top | Displays real-time view of a running processes |
| echo $SHELL | Shows the path to the bash executable |
| echo {con,pre} {sent,fer} {s,ed} | Display / Prints the value with the curly braces |
| man ls | Displays/provides the usage of command “ls” |
| man who | Displays/provides the usage of command “who” |
| clear | Clears the terminal screen |
| cal 2000 | Displays the calendar of the year 2000 |
| cal 9 1752 | Displays the September calendar of year 1752  The Gregorian Reformation is assumed to have occurred in 1752 on the 3rd of September. Ten days following that date were eliminated by the reformation, so the calendar for that month is a bit unusual. |
| yes please | yes outputs “y” (if no defined text), or a user-defined string of text continuously until killed. |
| time sleep 5 | Time -> time run the program command with any given arguments  Sleet -> delay for a specified amount of time  Time sleep 5 -> current terminal session waits for 5 seconds |
| history | Lists all the commands executed in that user session |



### Q2.2: Questions

This is a research project. Use Google to help you identify a solution.

For each of the commands marked with an \*, group them into a shell script so that you can automate execution of the commands. Write the shell script using the Vim text editor.

Once you have verified that the script works, add output redirection to append the output of each command to a file named as follows: firstnameSurname.txt (replacing firstname and surname with your own details). When writing to this text file, make liberal use of the echo command within the shell script to format the output nicely – i.e. insert blank lines or other demarcations and headings to make your file easily readable.

For the submission: Copy and paste the contents of this auto-created “.txt” file into your “.docx” document for submission. You are also required to upload the shell script which you wrote and the text file which it generated.